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Invertebrate Sample Data from the Campbell and Fraser River Estuaries from Natural and Developed Fish Habitats, 1987 and 1988

T. R. Whitehouse, B. N. Kamimura, P. A. Poon,
S. Dionne, B. A. Raymond and C. D. Levings

Department of Fisheries and Oceans
Biological Sciences Branch
West Vancouver Laboratory
4160 Marine Drive
West Vancouver, British Columbia V7V 1N6

June 1989

Canadian Data Report of Fisheries and Aquatic Sciences No. 762

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INVERTEBRATE SAMPLE DATA FROM THE CAMPBELL AND FRASER RIVER ESTUARIES FROM NATURAL AND DEVELOPED FISH HABITATS, 1987 AND 1988

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Department of Fisheries and Oceans
Biological Sciences Branch
West Vancouver Laboratory
4160 Marine Drive
West Vancouver, British Columbia V7V 1N6

90-01118/

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Cat. No. Fs 97-13/762E ISSN 0706-6465

Correct citation for this publication:

Whitehouse, T. R., B. N. Kamimura, P. A. Poon, S. Dionne, B. A. Raymond and C. D. Levings. 1989. Invertebrate sample data from the Campbell and Fraser River estuaries from natural and developed fish habitats, 1987 and 1988. Can. Data Rep. Fish. Aquat. Sci. 762: 39 p.

ABSTRACT

Whitehouse, T. R., B. N. Kamimura, P. A. Poon, S. Dionne, B. A. Raymond and C. D. Levings. 1989. Invertebrate sample data from the Campbell and Fraser River estuaries from natural and developed fish habitats, 1987 and 1988. Can. Data Rep. Fish. Aquat. Sci. 762: 39 p.

Data are presented on the invertebrates collected at both the Campbell and Fraser River estuaries as part of a study to compare the productivity of natural and reclaimed fish habitats. Three collection methods were used: insect-emergence trapping, benthic quadrat sampling; and dredge sampling. Marsh plant samples were also collected from one area of the Fraser River estuary.

Key words: Campbell River Estuary, Fraser River Estuary, insect-emergence traps, benthic samples, marsh plants

RÉSUMÉ

Whitehouse, T. R., B. N. Kamimura, P. A. Poon, S. Dionne, B. A. Raymond and C. D. Levings. 1989. Invertebrate sample data from the Campbell and Fraser River estuaries from natural and developed fish habitats, 1987 and 1988. Can. Data Rep. Fish. Aquat. Sci. 762: 39 p.

Des données sont présentées sur les invertébrés prélevés dans les estuaires du fleuve Fraser et de la rivière Campbell dans le cadre d'une étude visant à comparer la prducitivité d'habitats de poissons naturels et d'habitats de poissons régénérés. Trois méthodes de collecte ont été utilisées : pièges d'émergence d'insectes, échantillonnage de quadrats benthiques et échantillonnage à la drague. Des échantillons de plantes palustres ont également été prélevés dans une zone de l'estuaire de fleuve Fraser.

Mots-clés: estuaire de la rivière Campbell, estuaire de fleuve Fraser, pièges d'émergence d'insectes, échantillons benthiques, plantes palustres

INTRODUCTION

The Policy for the Management of Fish Habitat (Department of Fisheries and Oceans, 1986) states that the unavoidable destruction of fish habitat must be compensated for by the creation of suitable new habitat which will offset any loss. This policy also states that fish habitat should be rehabilitated or reclaimed in areas where economic and social benefits can be attained through an improved fisheries resource. One component of the rehabilitation or reclamation of fish habitat consists of marsh creation and planting.

The objective of this study was to compare the abundance of invertebrates from both natural and created marsh habitats. Quantitative data on taxonomic composition and seasonal abundance of invertebrates produced by estuarine marshes are presented with the objective of providing information on the success of fish habitat restoration in estuaries. The gauge, in this case, of the relative success of habitat rehabilitation or development is the abundance of potential fish prey items. Samples were collected from both natural and created marsh habitats and a rip-rapped gravel beach at three study locations in 1987 and 1988 in an attempt to define differences in fish prey items present at each site.

Two study areas were located in the Lower Fraser River Estuary (Figure 1). In 1987, comparisons were made between a natural marsh and a rip-rapped gravel beach that had been affected by industrial construction in the North Arm of the Fraser River on the north shore of Mitchell Island channel (south foot of Kent Street). The most striking difference between the sites was that the natural site (upstream of a railway trestle) was characterized by marsh vegetation (especially sedge, Carex lyngbyei), whereas the affected site (downstream of the railway trestle) was a mud and sand substrate beach. Data from insect-emergence traps (Table 3) and benthic invertebrate sampling (Tables 6 and 7) are presented from this area. The results of a beach seine sampling program to assess seasonal fish abundance in this area are presented elsewhere (Brown et al., 1989). The second study area was located in Annacis Channel off the Main Arm of the Fraser River and was sampled during 1988. An off-channel embayment was dredged adjacent to Annacis Channel and new marsh habitat was planted in early spring 1986 as compensation for losses incurred during the construction of the Queensborough Connector of the Alex Fraser Bridge (Harder and Assoc., 1988). Data from insect-emergence traps (Table 4), and marsh plant sampling at Annacis Channel (Table 8) are included in this report.

The third study area was located in the Campbell River Estuary (Figure 2). The created marsh habitats were formerly part of a water-based log sorting and storage area. The forestry company changed their operation to a dry land sort, log dump and storage area. Four marsh islands were created in the area of the former water-based log sort (Brownlee et al., 1984; Levings and Macdonald, 1989), using material salvaged from the construction of the dry land sort. The islands were planted in February and March 1982 and data have been collected subsequently on vegetation and invertebrate communities and on fish utilization (Brown et al., 1983; 1987; Kask et al., 1988). This report presents data on insect emergence collected in 1988 from four intertidal islands within the estuary (Table 5). Insects were collected from marshes at three developed islands (Islands 1,3, and 4) and an intact reference site at Nunns Island (Figure 5).

METHODS AND MATERIALS

Insect-Emergence Traps

Insect-emergence traps were utilized at all three study areas. The type of trap used was modeled after the Model DAY trap described by LeSage and Harrison (1979). The trap was designed as a floating pyramidal structure that could be used in running water and collect emerging insects for a duration of approximately 24 hours. Each trap sampled an area of 0.5 m^2 with a mesh size of 202 microns. A 500 ml plastic sampling jar was secured in the apex of the sampling net using an elastic band. The nets were anchored using a stake and lanyard, the lanyard attaching the trap to a single stake driven into the substrate. Flotation was provided by a string of standard gill-net floats tied to the base of the aluminum net frame.

Within each study area both natural and created marsh sites were examined, except at Mitchell Island Channel where a natural marsh site was compared to a non-reclaimed site that had been affected by industrial construction. In this report the natural marsh at Mitchell Island is denoted as MI5 and the affected site as MI4 (Figure 3). Sampling took place from April to December 1987 on a schedule of at least monthly sampling intervals. Because of vandalism and damage to traps at MI4 this sampling site was moved in July 1987 to another unvegetated area on the south shore of Mitchell Island Channel (Figure 3). The insect emergence data collected from Mitchell Island during 1987 are shown in Table 3.

At the Annacis Channel study area, the natural marsh sites were located at Patrick Island (PIC), Annacis 1 (AN1) and Annacis 2 (AN2) while the created marsh was at Patrick Bay (PBR) (Figure 4). Sampling was carried out from April to August 1988 on a biweekly schedule. Insect emergence data are shown in Table 4. At the Campbell River Estuary study area, the natural marsh site was located on Nunns Island (NUN) while the reclaimed sites were on Island 1 (IS1), Island 3 (IS3) and Island 4 (IS4) (Figure 5). At these sites, three sampling trips were scheduled during May and June 1988 at two week intervals. Insect emergence data are presented in Table 5.

Emergence traps were set at low tide. At each individual site within each study area, 3 to 6 traps were set. Collection of the traps occurred the following day at low tide, thereby sampling for a period of approximately 24 hours. The traps were collected following the procedure outlined in LeSage and Harrison (1979). The insects were killed by placing the net in a 20 litre bucket containing paper towel dampened with 100% ethyl acetate, the bucket was then tightly sealed for 5 to 10 minutes. Insects were then picked from the net, using forceps where necessary, and collected in the sample jar. Samples were labelled and preserved with 100% isopropyl alcohol. Identification of the samples to the family level was conducted using Wild M-5 dissecting microscopes, Zeiss compound microscopes and appropriate taxonomic keys (Chu, 1949; Borror and DeLong, 1964; Borror and White, 1970; Merritt and Cummins, 1978; Borror, DeLong and Triplehorn, 1981).

Quadrat and Dredge Samples

Both benthic quadrat and dredge samples were obtained from the two Mitchell Island sites. Each benthic quadrat sampled an area of 0.06 m^2.

Three replicate samples were collected at both low and high tide levels, estimated at 0.5 m and 1.5 m above chart datum respectively, totalling 12 samples. A trowel was used to remove the substrate layer to a depth of 2 cm. The material was fixed in formalin (10%) and stained with Rose Bengal. Benthic quadrat data are presented in Table 6.

Dredge samples were obtained by pulling the device over sediments for a distance of 5 m. The dredge mouth opening measured 25 cm in width, with a collection net mesh of 500 microns. Three replicates at MI4 and MI5 at high tide elevation and one replicate at MI5 at low tide elevation were sampled. Samples were fixed in 10% formalin and stained with Rose Bengal. Dredge sample data are presented in Table 7.

In the laboratory, both the quadrat and epibenthic samples were sieved by washing on a 500 micron screen and then transferred to isopropyl alcohol (40%). Before analysis they were again sieved on 4 mm and 500 micron mesh respectively. All invertebrates retained on 4 mm mesh were identified and counted. A Folsom plankton splitter was used to subsample the fraction retained on the 500 micron mesh so that a minimum of 200 invertebrates were identified and counted. Invertebrates were identified and counted using a Wild M-5 dissecting microscope and a Zeiss compound microscope. Several taxonomic keys were used to identify invertebrates down to order, family, genus or species depending on the type of organism (Chu, 1949; Edmondson, 1959; Borror and DeLong, 1964; Kozloff, 1974; Smith and Carlton, 1975; Merritt and Cummins, 1978; Borror, DeLong and Triplehorn, 1981; Clarke, 1981; Hobson and Banse, 1981; Merritt and Cummins, 1984; Kathman et al., 1986).

Marsh Plant Sampling

Marsh plants were sampled at the Annacis Channel study sites on July 27, 1988. At each site, after the insect traps were collected, the marsh plants within the frame of the insect traps ($0.5\ m^2$) were clipped . Shears were used to cut and collect all plant material greater than 2.5 cm in height. Plant material taller than 2.5 cm was collected to determine above ground emergent vegetation biomass and species composition, with a minimum of detrital material. The samples were placed in plastic bags and labelled. In the laboratory, the samples were stored in a freezer (at $-20^{\circ}C$) until sorting and identification was carried out. Plants were identified to species, and sorted accordingly. Identifications were verified using Hitchcock and Cronquist (1981). The samples were then dried, separately by species, in a Lab-Line Imperial II Radiant Heat Oven at $100^{\circ}C$ for up to 48 hours to constant weight, then cooled in a Nalge vacuum desiccator which contained silica-gel desiccant for a period of 24 hours. Weights were then taken with a K-TRON electronic balance. Data regarding plant species composition and biomass are presented in Table 8.

ACKNOWLEDGEMENTS

We wish to acknowledge the West Vancouver Chamber of Commerce and their Job Development Project employees who provided invaluable assistance in both the field and the lab. Assistance was also provided by summer students Suzanne Doyle and Terri Sutherland. Thanks also go out to Tom J. Brown in Nanaimo and Ed Choromanski in West Vancouver.

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Table 1. Insect codes for Fraser River and Campbell River insect emergence trap samples, 1987 and 1988.

DIPTERA
- CHIA=Chironomidae adult
- CHIP=Chironomidae pupae
- CERA=Ceratopogonidae adult
- CERP=Ceratopogonidae pupae
- ANTH=Anthomyiidae
- BIBI=Bibionidae
- CANA=Canaceidae
- CECI=Cecidomyiidae
- CHLR=Chloropidae
- DOLI=Dolichopodidae
- EMPI=Empididae
- EPHY=Ephydridae
- LONC=Lonchopteridae
- MUSC=Muscidae
- OTIT=Otitidae
- PHOR=Phoridae
- PSYC=Psychodidae
- PTYC=Ptychopteridae
- SCIA=Sciaridae
- SCMA=Sciomyzidae adult
- SCML=Sciomyzidae larvae
- SIMU=Simuliidae
- SPHA=Sphaeroceridae
- TIPU=Tipulidae

HYMENOPTERA
- BRAC=Braconidae
- CYNI=Cynipidae
- ENCY=Encyrtidae
- EULO=Eulophidae
- FORM=Formicidae
- ICHN=Ichneumonidae
- PTER=Pteromalidae
- MYMA=Mymaridae
- SCEL=Scelionidae
- TENT=Tenthredinidae

COLEOPTERA
- CARA=Carabidae
- CHRY=Chrysomelidae
- COCC=Coccinellidae
- CULI=Culicidae
- CURC=Curculionidae
- LATH=Lathridiidae
- NITI=Nitidulidae
- STAP=Staphylinidae

PLECOPTERA
- CHLO=Chloroperlidae
- LEUC=Leuctridae
- PERL=Perlodidae

PSOCOPTERA
- PSEU=Pseudocaeciliidae
- PSOC=Psocidae

HOMOPTERA
- APHI=Aphididae
- CICA=Cicadellidae
- CHER=Chermidae
- PSYL=Psyllidae

HEMIPTERA
- ANTO=Anthocoridae
- LYGA=Lygaeidae
- SALD=Saldidae

THYSANOPTERA
- PHLA=Phlaeothripidae
- THRI=Thripidae

LEPIDOPTERA
- COSM=Cosmopterygidae
- OLEL=Olethreutidae larvae
- PYRA=Pyralidae

ODONATA
- COEN=Coenagrionidae

TRICHOPTERA
- PSHO=Psychomyiidae

COLLEMBOLA
- PODU=Poduridae

ARACHNIDA
- ACAR=Acarina
- ARAN=Araneae

Table 2. Fraser River benthic macroinvertebrate codes for quadrat and dredge samples, 1987.

PLAT=Platyhelminthes
OLIG=Oligochaeta

POLYCHAETA
  HOBS=*Hobsonia* sp.

NEMT=Nematoda
TARD=Tardigrada
EGGS=Eggs
DIPTERA
  CHIL=Chironomidae larva
  CHIP=Chironomidae pupae
  CHIA=Chironomidae adult
  CERL=Ceratopogontidae larvae
  CERP=Ceratopogontidae pupae
  CERA=Ceratopogontidae adult
  DOLL=Dolichopodidae larvae
  DOLP=Dolichopodidae pupae
  DOLA=Dolichopodidae adult
  EMPL=Empididae larvae
  SCML=Sciomyzidae larvae
  SCIA=Sciaridae adult
  SYRP=Syrphidae larvae
  TIPL=Tipulidae larvae

COLLEMBOLA
  HYPO=Hypogastruridae
  SMIN=Sminthuridae

HYMENOPTERA
  BRAC=Braconidae adult
  EULO=Eulophidae adult
  PTER=Pteromalidae adult
  SCEL=Scelionidae adult

COLEOPTERA
  CARL=Carabidae larvae
  CURL=Curculionidae adult
  HALL=Haliplidae larvae

HOMOPTERA
  APHI=Aphididae adult
  CICA=Cicadidae adult
  PSYL=Psyllidae adult

PSOCOPTERA
  PSEN=Pseudocaeciliidae nymph
EPHEMEROPTERA
  SIPN=Siphlonuridae nymph
PLECOPTERA
  CAPN=Capniidae nymph

HEMIPTERA
  MIRN=Miridae nymph
THYSANOPTERA
  PHLA=Phlaeothripidae adult

SYMPHYLA
  SYMP=Symphyla

ARACHNIDA
  ARAN=Araneae
  ACAR=Acarina

COPEPODA
  HARP=Harpacticoida
  CYCL=*Cyclops* sp.
  PARA=*Paracyclops* sp.

CLADOCERA
  ALON=*Alona* sp.
  CERI=*Ceriodaphnia* sp.
  DAPH=*Daphnia* sp.
  DIAP=*Diaphanosoma* sp.
  ILYO=*Ilyocrytus* sp.

AMPHIPODA
  CRAN=*Crangonyx* sp.
  CORO=*Corophium* sp.
ISOPODA
  ASEL=*Asellus* sp.
CUMACEA
  CUME=*Cumella* sp.
MYSIDACEA
  NEOM=*Neomysis mecredis*

BIVALVIA
  SPHA=Sphaeridae
GASTROPODA
  LYMN=Lymneidae

FISH
  BTHJ=Bothidae juvenile
  FISL=Fish larvae

Table 3. Fraser River insect emergence trap samples, 1987.

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1987 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CHIP	CERA	ANTH	BIBI	CECI	CHLR	DOLI	EMPI	EPHY	LONC	OTIT	PTYC	SCIA	SCMA	SPHA	BRAC
MI4	870409	1415	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870409	1415	1	3	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870409	1415	2	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870409	1415	3	3	7	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
MI5	870430	0900	1	2	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870430	0900	2	2	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870514	1000	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870514	1004	2	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
MI5	870514	0945	1	5	151	0	4	0	0	0	0	0	2	0	0	0	0	0	0	0	0
MI5	870514	0945	2	5	53	0	2	3	0	0	0	3	1	0	0	0	0	0	0	0	0
MI5	870514	0945	3	5	32	0	9	0	0	0	0	5	1	0	0	0	0	0	0	0	0
MI5	870514	0945	4	5	50	0	3	0	0	0	0	1	0	1	0	1	0	0	0	0	0
MI5	870514	0945	5	5	7	0	3	0	0	0	0	16	0	0	0	0	2	0	0	0	1
MI4	870529	1034	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870529	1034	2	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870529	1050	1	5	6	0	1	0	0	0	0	1	0	3	0	0	0	0	0	0	0
MI5	870529	1050	2	5	8	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
MI5	870529	1050	3	5	9	0	1	0	0	0	0	2	2	0	0	0	0	0	0	0	0
MI5	870529	1050	4	5	10	0	2	0	0	0	0	5	0	0	0	0	0	0	0	0	1
MI5	870529	1050	5	5	5	0	13	0	0	0	0	0	1	3	0	0	0	0	0	0	0
MI4	870611	0930	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENCY	EULO	ICHN	MYMA	SCEL	TENT	CARA	COCC	NITI	LEUC	PSEU	APHI	CICA	CHER	ANTO	PHLA	THRI	COEN	PSHO	PODU	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	19
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58
0	0	0	0	0	0	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	36
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	17
2	0	1	1	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	0	1	31
0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	28
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1987 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CHIP	CERA	ANTH	BIBI	CECI	CHLR	DOLI	EMPI	EPHY	LONC	OTIT	PTYC	SCIA	SCMA	SPHA	BRAC
MI4	870611	0900	2	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870611	0975	3	4	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870611	0915	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870611	0945	1	5	49	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MI5	870611	0945	2	5	5	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MI5	870611	0945	3	5	5	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MI5	870611	0950	4	5	12	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	2
MI5	870611	0955	5	5	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MI4	870623	1649	1	2	20	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MI4	870623	1649	2	2	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MI5	870623	1649	1	2	50	0	1	0	0	0	0	5	3	0	0	0	0	0	1	0	1
MI5	870623	1649	2	2	48	0	9	0	0	0	16	10	0	10	0	0	0	0	0	0	1
MI5	870708	1649	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870708	1649	2	2	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	1
MI4	870724	0845	1	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870724	0845	2	4	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870724	0845	1	4	4	1	1	0	0	0	1	0	1	0	1	0	0	0	0	1	0
MI5	870724	0845	2	4	9	2	5	0	0	1	0	1	0	1	0	0	0	0	0	0	0
MI5	870724	0845	3	4	18	2	19	0	0	0	0	4	0	2	0	0	0	0	0	0	0
MI5	870724	0845	4	4	9	2	9	0	0	0	0	3	0	0	0	0	0	0	0	5	0
MI4	870820	1000	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENCY	EULO	ICHN	MYMA	SCEL	TENT	CARA	COCC	NITI	LEUC	PSEU	APHI	CICA	CHER	ANTO	PHLA	THRI	COEN	PSHO	PODU	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	1	0	1	9
0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	6
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
0	0	0	1	0	0	0	1	0	0	0	7	0	1	0	0	0	3	0	0	0	0	20
0	1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	22
0	1	0	1	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	1	19
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	96
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	19
0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	2	0	0	0	0	0	25
0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	54
0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	34
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1987 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CHIP	CERA	ANTH	BIBI	CECI	CHLR	DOLI	EMPI	EPHY	LONC	OTIT	PTYC	SCIA	SCMA	SPHA	BRAC
MI4	870820	1000	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870820	1000	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870820	1000	4	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MI5	870820	1015	1	4	10	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MI5	870820	1015	2	4	10	0	2	0	0	1	0	1	0	1	0	0	0	0	0	0	0
MI5	870820	1015	3	4	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MI5	870820	1015	4	4	7	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MI4	870917	1030	1	4	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MI4	870917	1030	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870917	1030	3	4	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	870917	1030	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870917	1115	1	4	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
MI5	870917	1115	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MI5	870917	1115	3	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	870917	1115	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MI4	871015	0940	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MI4	871015	0940	2	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	871015	0940	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	871015	0940	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	871015	0830	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	871015	0830	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENCY	EULO	ICHN	MYMA	SCEL	TENT	CARA	COCC	NITI	LEUC	PSEU	APHI	CICA	CHER	ANTO	PHLA	THRI	COEN	PSHO	PODU	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	14
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	19
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1987 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CHIP	CERA	ANTH	BIBI	CECI	CHLR	DOLI	EMPI	EPHY	LONC	OTIT	PTYC	SCIA	SCMA	SPHA	BRAC
MI5	871015	0830	3	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	871202	0930	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	871202	0930	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	871202	0945	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	871202	0945	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI5	871202	0945	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ENCY	EULO	ICHN	MYMA	SCEL	TENT	CARA	COCC	NITI	LEUC	PSEU	APHI	CICA	CHER	ANTO	PHLA	THRI	COEN	PSHO	PODU	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Table 4. Fraser River insect emergence trap samples, 1988.

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM	ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
AN2	880316	1211	1	2	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
AN2	880316	1207	2	2	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
PBR	880316	1130	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880316	1132	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
PBR	880316	1134	3	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
PBR	880316	1136	4	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
PBR	880331	0950	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880331	0950	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880331	0950	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880331	0950	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880331	1010	1	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880331	1010	2	2	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880422	1240	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880422	1500	2	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880422	1500	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880422	1240	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880422	1245	1	3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880422	1245	2	3	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880422	1445	3	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880506	1710	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880506	1710	2	4	8	0	0	0	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM
PBR	880506	1710	3	4	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880506	1710	4	4	1	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	0
PIC	880506	1645	1	4	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880506	1645	2	4	211	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
PIC	880506	1645	3	4	209	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880506	1645	4	4	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880520	1200	1	4	18	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880520	1200	2	4	15	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880520	1200	3	4	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880520	1200	4	4	8	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
PBR	880520	1120	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880520	1120	2	4	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880520	1120	3	4	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880520	1120	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880520	1135	1	4	80	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880520	1135	2	4	61	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
PIC	880520	1135	3	4	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880520	1135	4	4	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880603	1440	1	4	34	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880603	1440	2	4	12	16	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AN1	880603	1440	3	4	49	12	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0

ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	213
0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	213
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83
1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	66
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	45
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	30
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM
AN1	880603	1440	4	4	44	82	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0
AN2	880603	1420	1	2	28	1	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0
AN2	880603	1420	2	2	8	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0
PBR	880603	1255	1	4	6	2	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0
PBR	880603	1255	2	4	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
PBR	880603	1255	3	4	4	3	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0
PBR	880603	1255	4	4	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
PIC	880603	1325	1	4	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880603	1325	2	4	76	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880603	1325	3	4	34	4	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
PIC	880603	1325	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880616	1240	1	4	8	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880616	1240	2	4	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880616	1240	3	4	8	1	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0
AN1	880616	1240	4	4	12	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
AN2	880616	1205	1	4	28	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
AN2	880616	1205	2	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN2	880616	1205	3	4	39	1	0	0	0	2	3	1	0	0	0	0	0	0	0	0	0	0
AN2	880616	1205	4	4	20	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
PBR	880616	1015	1	4	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
PBR	880616	1015	2	4	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	133
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	14
0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	13
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
0	0	0	0	0	0	0	0	0	0	65	3	0	0	0	0	0	3	0	0	0	1	149
0	1	0	0	0	0	0	0	0	0	4	10	0	0	0	0	0	1	0	0	0	1	58
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	9
0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	49
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	24
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	6

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM
PBR	880616	1015	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880616	1015	4	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880616	1100	1	3	19	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	0
PIC	880616	1100	2	3	12	0	0	0	0	1	0	3	0	0	0	0	0	0	0	1	0	0
PIC	880616	1100	3	3	23	0	0	1	0	2	0	2	0	0	0	0	0	0	0	0	0	0
AN1	880629	1232	1	4	68	3	0	0	0	1	1	4	0	0	0	0	0	0	0	0	0	0
AN1	880629	1232	2	4	34	0	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
AN1	880629	1232	3	4	14	1	1	0	0	3	3	1	0	0	0	0	0	0	0	1	0	0
AN1	880629	1232	4	4	33	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
AN2	880629	1130	1	3	49	2	0	0	0	2	3	2	0	0	0	0	0	0	0	2	0	0
AN2	880629	1130	2	3	27	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
AN2	880629	1130	3	3	28	2	0	0	0	2	4	0	0	0	1	0	0	0	0	2	0	0
PBR	880629	1410	1	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880629	1410	2	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
PBR	880629	1410	3	4	15	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
PBR	880629	1410	4	4	9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880629	1315	1	4	28	3	0	1	0	1	0	2	0	0	0	0	0	0	0	1	0	0
PIC	880629	1315	2	4	8	4	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
PIC	880629	1315	3	4	26	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
PIC	880629	1315	4	4	18	0	0	0	0	1	1	3	0	0	0	0	0	0	0	2	0	0
AN1	880713	1150	1	4	60	0	0	0	0	2	0	1	0	0	0	0	0	0	0	2	0	0

ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	26
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	29
0	0	0	0	1	0	0	0	1	0	16	0	0	0	0	0	0	0	0	0	0	0	95
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	32
0	0	0	0	1	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	1	48
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	62
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	31
0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	43
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
0	1	0	0	0	0	0	0	0	0	268	1	0	0	0	0	0	0	0	0	0	0	306
0	1	0	0	0	0	0	0	0	0	324	0	0	0	0	0	0	0	1	0	0	0	341
0	1	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0	55
0	1	0	0	0	0	0	0	0	0	1524	1	0	0	0	0	0	0	0	0	0	4	1555
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM
AN1	880713	1150	2	4	56	1	1	0	0	5	0	2	0	0	0	0	0	0	0	1	0	0
AN1	880713	1150	3	4	50	2	3	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0
AN1	880713	1150	4	4	34	0	4	0	0	4	1	5	0	0	0	0	0	0	0	0	0	0
AN2	880713	1115	1	4	24	2	1	0	0	4	3	2	0	0	0	0	0	0	0	4	0	0
AN2	880713	1115	2	4	36	0	1	0	0	3	0	3	0	0	0	0	0	0	0	1	0	0
AN2	880713	1115	3	4	24	0	0	0	0	1	3	1	0	0	0	0	0	0	0	2	0	0
AN2	880713	1115	4	4	30	0	0	1	0	1	4	4	0	0	0	0	0	0	0	0	0	0
PBR	880713	0950	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880713	0950	2	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
PBR	880713	0950	3	4	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880713	0950	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880713	1000	1	4	15	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
PIC	880713	1000	2	4	53	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
PIC	880713	1000	3	4	16	3	0	0	0	3	0	35	0	0	0	0	0	0	0	28	0	0
PIC	880713	1000	4	4	5	0	0	0	0	0	0	5	0	0	0	0	0	0	0	42	0	0
AN1	880727	1130	1	4	53	2	3	0	0	3	0	2	0	0	0	0	0	0	0	1	0	0
AN1	880727	1130	2	4	46	7	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
AN1	880727	1130	3	4	52	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AN1	880727	1130	4	4	29	73	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0
AN2	880727	1130	1	4	10	41	0	0	0	5	0	4	0	0	0	0	0	0	0	0	0	0
AN2	880727	1130	2	4	56	4	0	0	0	10	0	4	0	1	0	0	0	0	0	1	0	0

ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51
0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0	51
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	33
0	0	0	0	0	0	0	0	2	0	6	0	0	0	0	0	0	0	0	0	0	0	48
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	22
0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	58
0	4	0	0	0	0	0	0	0	0	34	0	0	0	0	0	3	0	0	0	0	1	127
0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	1	0	0	0	0	0	62
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	65
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	64
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	109
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	61
0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM
AN2	880727	1130	3	4	23	1	0	0	0	15	0	5	1	0	0	0	0	1	0	17	0	0
AN2	880727	1130	4	4	30	6	0	0	0	3	0	3	0	0	0	0	0	0	0	6	0	0
PBR	880727	0924	1	3	5	0	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
PBR	880727	0924	2	3	10	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
PBR	880727	0924	3	3	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
PIC	880727	0920	1	4	10	17	0	1	0	9	0	3	0	0	0	0	0	0	0	2	1	0
PIC	880727	0920	2	4	4	7	1	0	0	3	0	11	0	0	0	0	0	0	0	7	3	0
PIC	880727	0920	3	4	15	4	0	1	0	0	0	9	0	0	0	0	0	0	0	4	1	0
PIC	880727	0920	4	4	9	3	1	0	0	3	0	5	0	0	0	0	0	0	0	6	4	0
AN1	880810	0945	1	4	145	17	6	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0
AN1	880810	0945	2	4	106	29	4	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0
AN1	880810	0945	3	4	15	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
AN1	880810	0945	4	4	18	46	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
AN2	880810	0900	1	4	6	11	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
AN2	880810	0900	2	4	19	14	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0
AN2	880810	0900	3	4	6	22	0	0	0	4	4	0	0	0	0	0	0	0	0	4	0	0
AN2	880810	0900	4	4	12	5	0	0	0	9	2	1	0	0	0	0	0	0	0	1	0	0
PBR	880810	0945	1	4	29	4	0	0	0	3	1	1	0	0	0	0	0	0	0	1	0	0
PBR	880810	0945	2	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880810	0945	3	4	20	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880810	0945	4	4	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0

ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66
0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	44
2	2	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	44
0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	38
3	3	0	0	0	0	1	0	0	1	10	0	0	0	2	0	6	0	0	0	0	4	61
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]
0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	146
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	20
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	68
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	41
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	40
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	12

FRASER RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CERP	CANA	CECI	DOLI	EMPI	EPHY	MUSC	PHOR	PSYC	SCIA	SCML	SPHA	TIPU	BRAC	EULO	FORM
PIC	880810	1000	1	4	5	30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
PIC	880810	1000	2	4	3	14	0	0	1	0	0	2	0	0	0	0	0	0	0	2	2	0
PIC	880810	1000	3	4	3	24	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0
PIC	880810	1000	4	4	6	15	0	0	0	1	0	2	0	0	0	0	0	0	0	5	1	0
AN2	880825	0925	1	3	21	3	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0
AN2	880825	0925	2	3	17	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0
AN2	880825	0925	3	3	16	13	0	0	0	18	0	1	0	0	0	0	0	0	0	4	1	0
PBR	880825	1050	1	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880825	1050	2	4	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
PBR	880825	1050	3	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PBR	880825	1050	4	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PIC	880825	1005	1	4	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
PIC	880825	1005	2	4	4	3	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	0
PIC	880825	1005	3	4	2	5	0	0	0	5	0	3	1	0	0	0	0	0	0	1	0	0
PIC	880825	1005	4	4	1	1	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0

ICHN	PTER	MYMA	SCEL	CHRY	COCC	CURC	LATH	CHLO	PSOC	APHI	CICA	LYGA	SALD	PHLA	THRI	COSM	OLEL	PYRA	COEN	ACAR	ARAN	TOTAL
0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	41
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	27
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
0	3	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	36
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	31
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	59
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	14
0	0	0	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	1	26
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10

Table 5. Campbell River insect emergence trap samples, 1988.

CAMPBELL RIVER INSECT EMERGENCE TRAP SAMPLES, 1988 (NUMBER OF INSECTS PER 0.5 METRE SQUARED)

SITE	DATE	TIME	REP	REPS	CHIA	CERA	CANA	CHLR	DOLI	EMPI	EPHY	MUSC	PSYC	TIPU	BRAC	EULO	CARA	CHRY	PERL	APHI	CICA	PSYL	ACAR	ARAN	TOTAL
IS1	880516	0840	1	6	11	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	12
IS1	880516	0840	2	6	10	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	13
IS1	880516	0840	3	6	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
IS1	880516	0840	4	6	12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	18
IS1	880516	0840	5	6	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
IS1	880516	0840	6	6	13	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	14
IS3	880516	0720	1	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
IS3	880516	0720	2	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
NUN	880516	0800	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NUN	880516	0800	2	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
NUN	880516	0800	3	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
NUN	880516	0800	4	4	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
IS1	880610	0848	1	5	70	17	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	106
IS1	880610	0848	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IS1	880610	0848	3	5	6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	10
IS1	880610	0848	4	5	18	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	35
IS1	880610	0848	5	5	13	20	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	37
IS3	880610	0729	1	2	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	1	0	0	0	8
IS3	880610	0729	2	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
IS4	880610	0750	1	3	10	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	13
IS4	880610	0750	2	3	12	6	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	21
IS4	880610	0750	3	3	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
NUN	880610	0805	1	4	19	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
NUN	880610	0805	2	4	27	3	0	0	2	2	1	0	0	0	0	0	0	4	0	1	0	0	0	0	40
NUN	880610	0805	3	4	82	0	0	0	3	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	87
NUN	880610	0805	4	4	24	3	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	31
IS1	880623	0740	1	6	28	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
IS1	880623	0840	2	6	22	9	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	36
IS1	880623	0840	3	6	29	3	0	0	4	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	40
IS1	880623	0840	4	6	22	4	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	57
IS1	880623	0840	5	6	61	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	68
IS1	880623	0840	6	6	33	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	38
IS3	880623	0720	1	3	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
IS3	880623	0740	2	3	7	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
IS3	880623	0720	3	3	6	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
IS4	880623	0745	1	3	18	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	26
IS4	880623	0745	2	3	14	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
IS4	880623	0720	3	3	14	0	0	0	8	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	25
NUN	880623	0800	1	4	34	2	0	0	2	0	2	0	0	0	8	0	0	0	0	0	0	0	0	0	48
NUN	880623	0800	2	4	36	2	1	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	45
NUN	880623	0800	3	4	9	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	13
NUN	880623	0800	4	4	25	0	0	0	15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	41

Table 6. Fraser River benthic quadrat macroinvertebrates, June 23, 1987.

FRASER RIVER BENTHIC QUADRAT MACROINVERTEBRATES, JUNE 23, 1987
(NUMBER OF INVERTEBRATES PER 0.06 METRE SQUARED)

SITE	REP	REPS	TIDES	PLAT	OLIG	HOBS	NEMT	TARD	EGGS	CHIL	CHIP	CHIA	CERL	CERP	CERA	DOLL	DOLP
MI4	1	3	HIGH	0	5	0	7	0	2	0	0	0	0	0	2	0	0
MI4	1	3	LOW	4	390	0	8	0	3	54	8	0	16	2	0	0	0
MI4	2	3	HIGH	0	2	0	0	0	0	0	1	2	0	2	3	0	0
MI4	2	3	LOW	1	568	0	32	8	10	32	0	0	16	8	0	0	0
MI4	3	3	HIGH	0	3	0	0	0	0	0	0	1	0	0	0	0	0
MI4	3	3	LOW	0	544	0	17	8	1	28	11	0	40	0	0	0	0
MI5	1	3	HIGH	0	532	0	236	0	544	64	8	1	20	0	0	24	5
MI5	1	3	LOW	0	415	0	28	0	34	36	40	1	8	2	0	0	0
MI5	2	3	HIGH	1	548	0	1156	0	15	36	5	1	9	0	0	14	0
MI5	2	3	LOW	20	1008	4	28	0	1	128	8	0	8	0	0	0	0
MI5	3	3	HIGH	0	359	0	704	0	64	36	13	0	0	1	0	21	4
MI5	3	3	LOW	1	1232	0	8	0	0	96	16	0	16	0	0	0	0

EMPL	HYPO	SMIN	CARL	APHI	MIRN	SYMP	ARAN	ACAR	HARP	PARA	ILYO	CRAN	CORO	ASEL	SPHA	LYMN	TOTAL
0	1	0	1	11	0	0	0	0	0	0	0	0	0	0	0	3	32
0	0	0	0	0	0	0	0	1	1	1	0	2	0	1	0	0	491
0	0	1	0	5	1	1	0	0	0	0	0	0	0	0	0	1	19
0	0	0	0	0	0	0	0	0	16	16	8	0	0	0	0	8	723
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	0	25	8	0	0	0	0	0	0	682
9	5	0	0	5	0	0	0	9	4	0	0	0	0	0	0	216	1682
0	0	0	0	0	0	0	1	1	9	0	0	1	0	0	0	9	585
0	4	0	0	0	0	0	1	1	0	0	0	0	0	0	0	40	1831
4	0	0	0	0	0	0	0	0	0	12	0	4	1	0	2	4	1232
0	13	0	0	15	0	0	0	16	0	0	0	0	0	0	0	181	1427
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1370

Table 7. Fraser River dredge samples, June 23, 1987.

FRASER RIVER DREDGE SAMPLES, JUNE 23, 1987

SITE	REP	REPS	TIDES	PLAT	OLIG	NEMT	EGGS	CHIL	CHIP	CHIA	CERL	CERP	CERA	DOLA	SCIA	SCML	SYRL	TIPL	HYPO	BRAC	EULO	PTER	SCEL	CURL	HALL
MI4	1	4	HIGH	0	70	13	0	19	3	5	2	1	0	0	0	0	0	1	2	0	0	0	0	1	0
MI4	2	4	HIGH	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MI4	3	4	LOW	24	1176	40	20	84	18	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MI4	4	4	HIGH	0	3	0	0	1	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
MI5	1	3	HIGH	0	2	1	0	0	0	1	0	3	4	0	1	0	0	0	1	0	0	0	1	0	0
MI5	2	3	HIGH	0	4	1	0	2	2	7	0	1	3	0	0	1	0	0	1	0	1	0	0	0	0
MI5	3	3	HIGH	0	6	1	0	4	0	3	0	0	1	1	0	0	1	0	0	2	0	1	0	0	1

APHI	CICA	PSYL	PSEN	SIPN	CAPN	MIRN	PHLA	ARAN	ACAR	HARP	CYCL	PARA	ALON	CERI	DAPH	DIAP	CRAN	ASEL	CUME	NEOM	SPHA	LYMN	BTHJ	FISL	TOTAL
2	1	0	0	0	1	0	1	0	1	0	1	1	0	0	1	3	0	0	1	0	0	6	0	0	136
0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	12
2	0	0	0	16	0	0	0	0	17	28	28	0	4	24	0	0	0	20	0	27	14	1	1	0	1564
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
5	0	1	0	0	0	0	0	12	3	0	0	0	0	0	0	0	0	1	0	0	0	0	35	0	0	71
15	0	0	1	0	0	0	1	5	2	1	0	0	0	0	0	0	0	1	0	0	0	0	21	0	2	72
1	0	0	0	0	0	1	1	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	52	0	0	86

Table 8. Vegetation samples from Annacis and Patrick Islands, July 27, 1988.

SITE	REP	PLANT SPECIES	WET WT. (gms) sq. m.	DRY Wt. (gms) sq. m.
AN1	1	Eleocharis palustris (L.) R. & S.	409.97	41.92
		Alisma plantago-aquatica (L.)	9.14	1.76
		Juncus oxymeris Engelm.	293.82	43.42
		TOTAL WT.	712.93	87.10
	2	Eleocharis palustris (L.) R. & S.	29.94	2.36
		Alisma plantago-aquatica (L.)	0.46	0.06
		Lythrum salicaria L.	4.22	0.09
		Deschampsia cespitosa (L.) Beauv.	60.28	7.34
		TOTAL WT.	94.90	9.85
	3	Carex lyngbyei Hornem.	688.16	105.48
		Eleocharis palustris (L.) R. & S.	315.27	41.80
		Equisetum laevigatum A. Br.	1.20	0.36
		TOTAL WT.	984.63	147.64
	4	Carex lyngbyei Hornem.	890.67	165.36
		Eleocharis palustris (L.) R. & S.	160.86	26.38
		Alisma plantago-aquatica (L.)	0.30	0.08
		TOTAL WT.	1051.83	191.82
AN2	1	Carex lyngbyei Hornem.	989.11	147.58
		Eleocharis palustris (L.) R. & S.	105.18	13.58
		Alisma plantago-aquatica L.	3.92	0.68
		Scirpus validus Vahl.	73.42	17.24
		Equisetum laevigatum A. Br.	1.58	0.54
		TOTAL WT.	1173.21	179.62
	2	Eleocharis palustris (L.) R. & S.	303.50	35.40
		Alisma plantago-aquatica L.	1.48	0.46
		Phalaris arundinacea L.	131.95	12.34
		Juncus articulatus L.	118.52	16.90
		TOTAL WT.	555.45	65.10

	3	Carex lyngbyei Hornem.	845.57	111.36
		Eleocharis palustris (L.) R. & S.	194.16	28.16
		Alisma plantago-aquatica L.	1.94	0.24
		TOTAL WT.	1041.67	139.76
	4	Carex lyngbyei Hornem.	19.22	4.24
		Eleocharis palustris (L.) R. & S.	395.90	69.80
		Alisma plantago-aquatica L.	1.42	0.66
		Scirpus validus Vahl.	130.15	28.80
		TOTAL WT.	546.69	103.50
PBR	1	Carex lyngbyei Hornem.	4.88	2.02
		Alisma plantago-aquatica (L.)	5.50	0.22
		Phalaris arundinacea L.	0.72	0.58
		Equisetum pratense Ehbr.	4.98	0.10
		Juncus balticus Willd.	15.54	6.50
		Myosotis laxa Lehm	0.14	0.10
		Unknown	0.34	0.16
		TOTAL WT.	32.10	9.68
	2	Phalaris arundinacea L.	0.14	0.06
		TOTAL WT.	0.14	0.06
	3	Carex lyngbyei Hornem.	41.78	5.98
		Lythrum salicaria	27.94	5.60
		Equisetum pratense Ehrb.	4.84	0.06
		Juncus balticus Willd.	5.40	1.48
		TOTAL WT.	79.96	13.12
PIC	1	Carex lyngbyei Hornem.	1378.39	288.62
		Eleocharis palustris (L.) R. & S.	76.06	12.94
		Alisma plantago-aquatica (L.)	12.76	2.24
		Phalaris arundinacea L.	27.70	5.62
		Lythrum salicaria L.	51.54	7.04
		TOTAL WT.	1546.45	316.46
	2	Carex lyngbyei Hornem.	496.80	72.08
		Eleocharis palustris (L.) R. & S.	359.52	55.58
		Phalaris arundinacea L.	251.80	46.58
		Lythrum salicaria L.	11.28	2.92
		TOTAL WT.	1119.40	177.16

3	Carex lyngbyei Hornem.	427.90	74.14
	Eleocharis palustris (L.) R. & S.	172.30	20.74
	Alisma plantago-aquatica (L.)	11.36	1.82
	Phalaris arundinacea L.	284.02	50.74
	Lythrum salicaria L.	369.87	42.92
	TOTAL WT.	1265.45	190.36
4	Carex lyngbyei Hornem.	51.70	10.94
	Eleocharis palustris (L.) R. & S.	864.98	122.92
	Alisma plantago-aquatica (L.)	0.12	0.08
	Phalaris arundinacea L.	1.02	0.56
	Equisetum laevigatum A. Br.	7.12	1.20
	Lythrum salicaria L.	3.70	0.86
	Sparganium eurycarpum Engelm.	248.26	30.48
	TOTAL WT.	1176.90	167.04

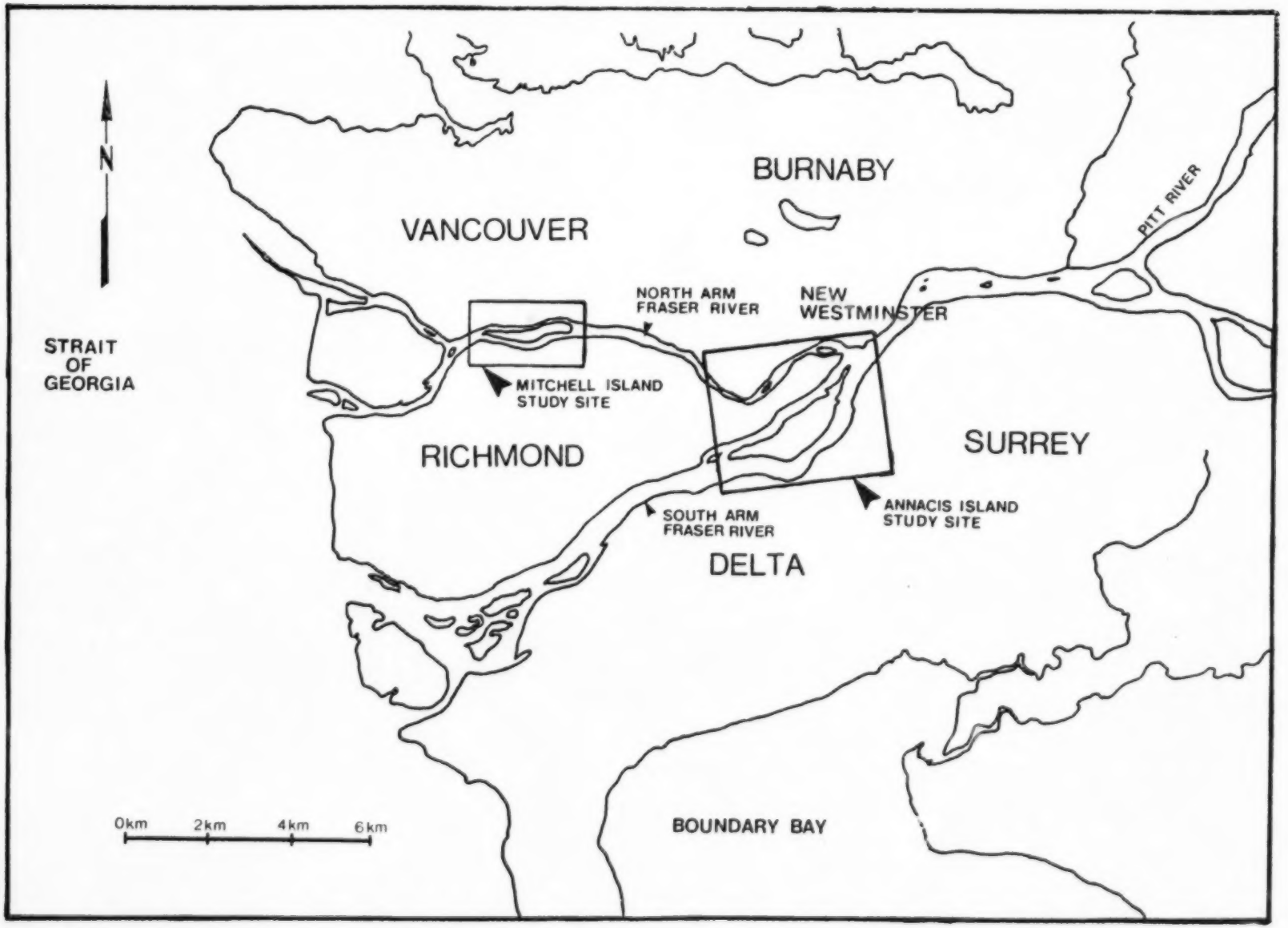


Figure 1. Location of Lower Fraser River study sites.

Figure 2. Location of Campbell River estuary study sites.

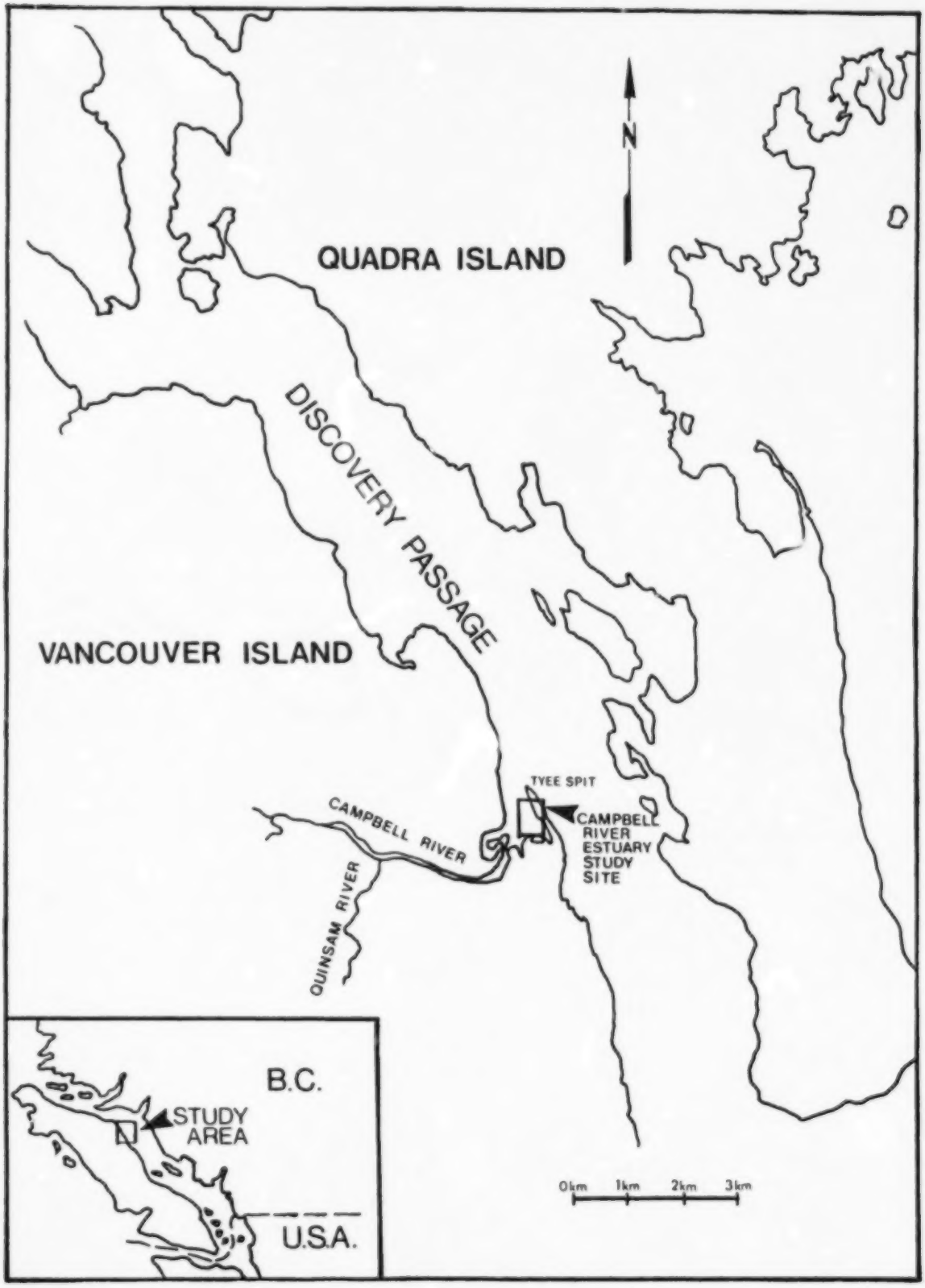

N
QUADRA ISLAND
DISCOVERY PASSAGE
VANCOUVER ISLAND
TYEE SPIT
CAMPBELL RIVER
CAMPBELL RIVER ESTUARY STUDY SITE
QUINSAM RIVER
B.C.
STUDY AREA
U.S.A.
0km 1km 2km 3km

Figure 3. Mitchell Island study sites.

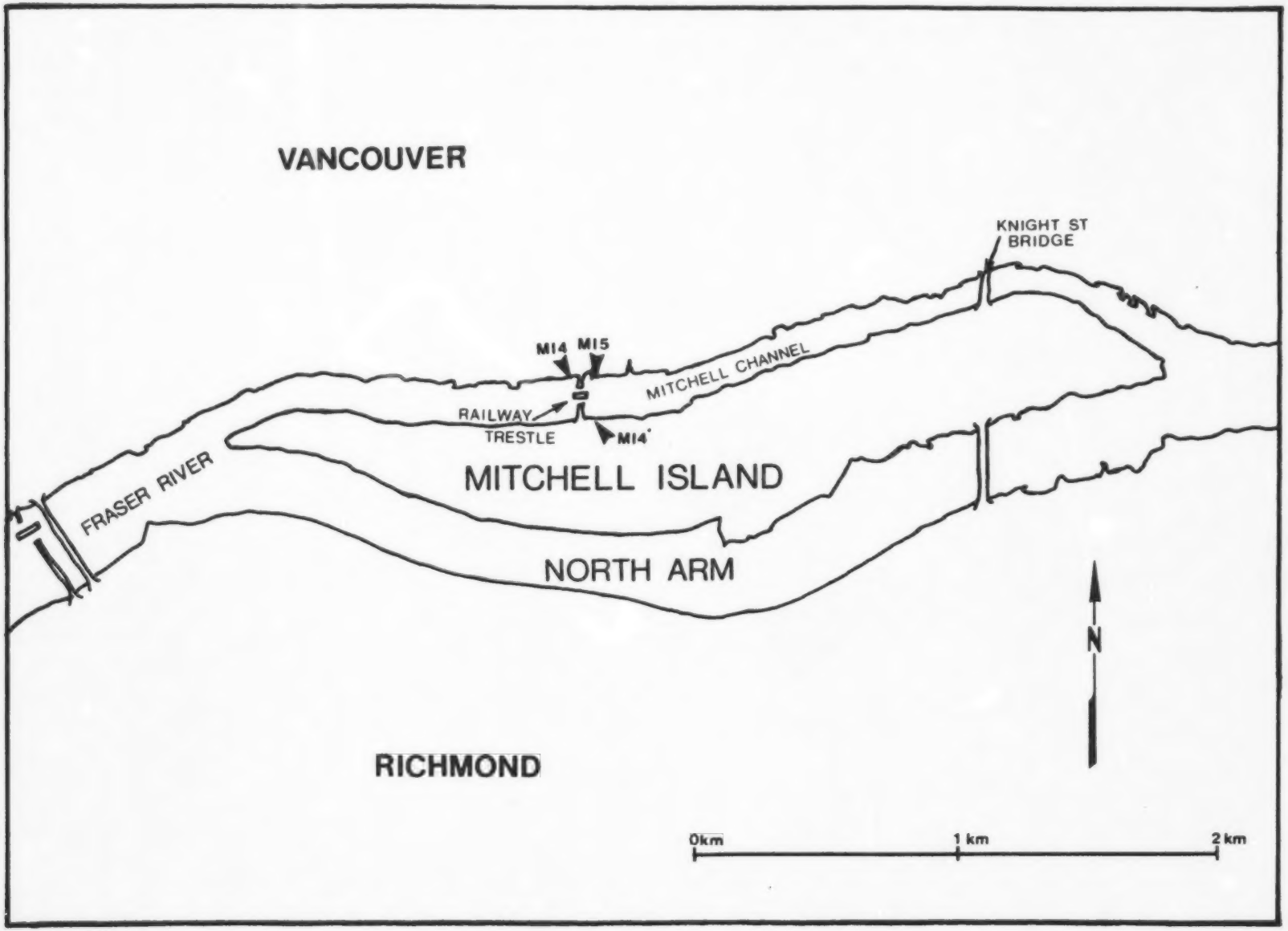

VANCOUVER
KNIGHT ST
BRIDGE
MI4 MI5
MITCHELL CHANNEL
RAILWAY
TRESTLE
MI4'
FRASER RIVER
MITCHELL ISLAND
NORTH ARM
N
RICHMOND
0km
1 km
2 km

Figure 4. Annacis Island study sites.

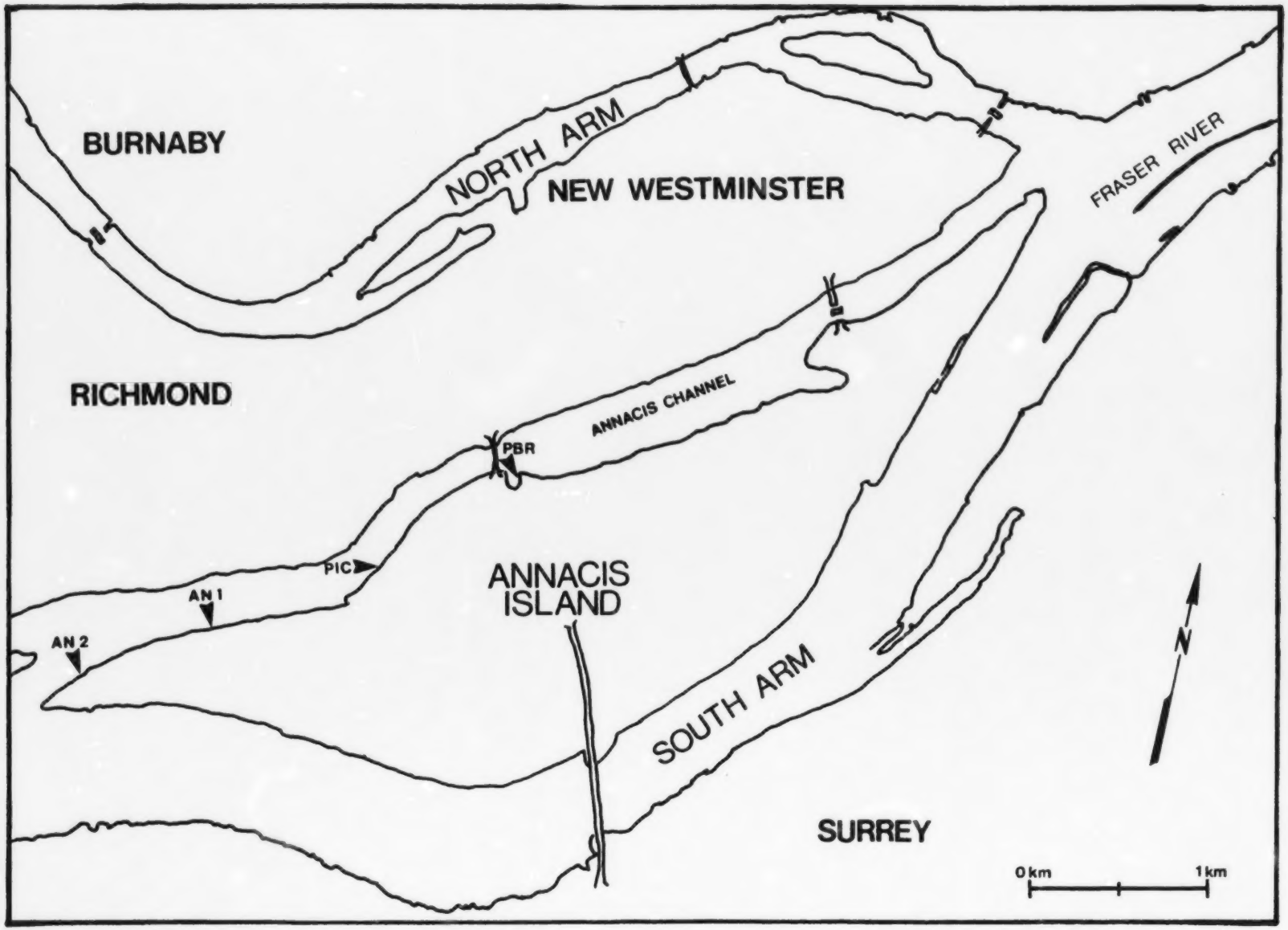
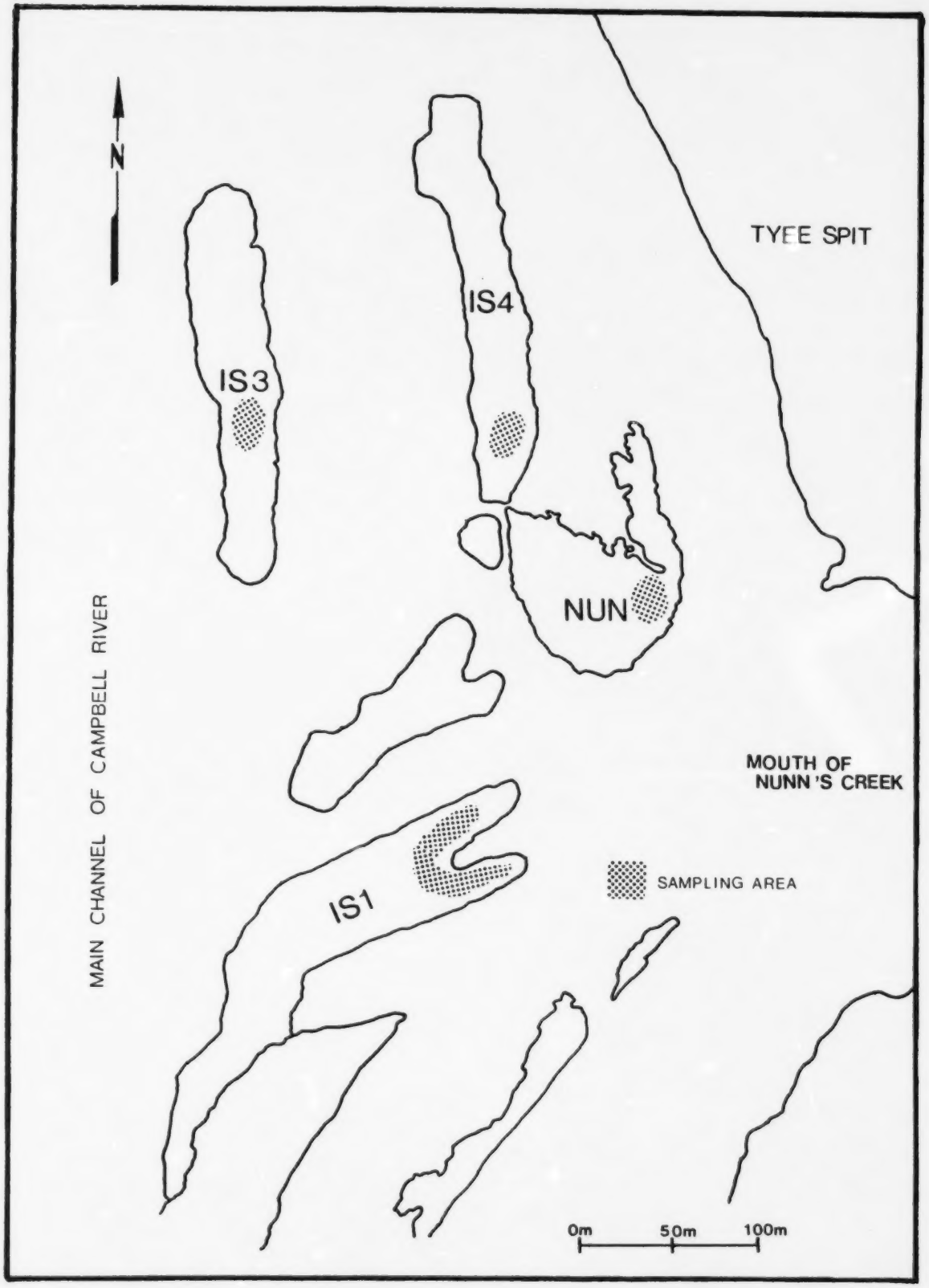

BURNABY
NORTH ARM
NEW WESTMINSTER
FRASER RIVER
RICHMOND
ANNACIS CHANNEL
PBR
PIC
AN 1
AN 2
ANNACIS
ISLAND
SOUTH ARM
N
SURREY
0 km
1 km

Figure 5. Campbell River estuary study sites.


N
TYEE SPIT
IS4
IS3
NUN
MAIN CHANNEL OF CAMPBELL RIVER
MOUTH OF
NUNN'S CREEK
IS1
SAMPLING AREA
0m
50m
100m